Twin Screw Multiphase Pumps for Bohai Bay Offshore Applications

Wellhead platform in Bohai Bay

Twin screw multiphase pumps have been installed on offshore platforms in Bohai Bay fields since 1997.

BY HANS-JÜRGEN SCHÖNER

Bohai Bay, located in the north eastern part of China is the countries largest offshore oil and gas production base and aims to be China's second biggest oil field in future. The oil and gas fields are operated by large Chinese oil producers or as production sharing contracts and partnerships with various international oil companies.

In 1997, the first Leistritz twin screw multiphase pumps have been installed on a platform in the Boxi Field in Bohai Bay. The three pumps are designed for a flow rate of 245 m³/h (37,000 bpd), a differential pressure of 46 bar (667 psi) and a GVF of up to 92 percent. After the production manifold, the multiphase fluid enters a production heater and the production separator. Part of the separated gas is used on the platform while the remaining gas as well as the separated liquid phase are delivered to the pump suction. The twin screw multiphase pumps boost the oil and gas mixture through a subsea pipeline to the well head platform, which is approximately 16 kilometres away.

Compared to the operation of a conventional system, the twin screw multiphase pumps offer several advantages:

- Transfer pump and natural gas compressor as well as separate flow lines were eliminated.
- Only one subsea pipeline was used to boost the multiphase fluid to the well head platform.
- Reduced investment because a gas dewatering facility was not required.

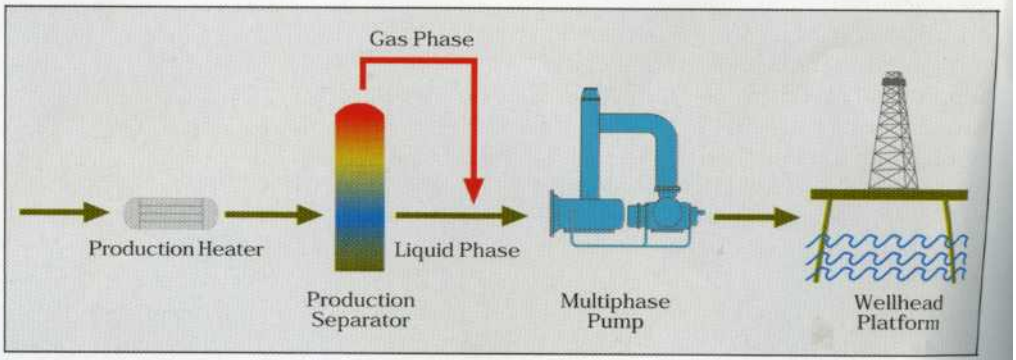
All three pumps operated smoothly with low pulsation, low noise and excellent suction capabilities.

In 2004, the same Chinese offshore oil producer decided to develop a new oil and gas field which is also located in Bohai Bay area. In order to exploit the rich oil and gas resources a new well head platform was installed. The oil, water and gas mixture is transferred by Leistritz multiphase pumps from the wellhead platform to the production platform through single pipeline of approx. 14.0 km length. Each pump delivers 143 m³/hr (21,500 bpd) at a differential pressure of 38.5 bar (558 psi).

Due to the severe weather conditions, the pumps and accessories on the skids have been heat traced and insulated to withstand the chilly temperatures during winter time. The pumps have been commissioned in 2007.

Multiphase Pumping Systems

Rotary positive displacement pumps and twin screw pumps in particular have been the base for the development of multiphase pumps during the last two decades. These versatile pumps handle products with low or high viscosity gently, with low shear and almost no pulsation. The pumped products can range from 100 percent liquid to 100 percent gas content (GVF). The use of variable speed drives offers a wide operating envelope. Maximum flow rates of up to 5,000 m³/hr (755,290 bpd) and differential pressures of up to 100 bar (1,450 psi) can be achieved.



***Process flow** (all illustrations/photos: Leistritz Pumpen)*

Leistritz high-pressure multiphase pump as installed on the 17-3 Platform

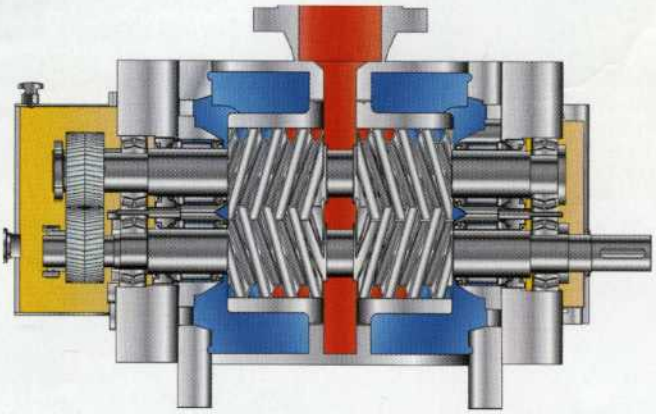
Leistritz high-pressure multiphase with heat tracing and insulation on a wellhead platform in Bohai Bay

Multiphase pumps are an economical alternative versus conventional upstream separation systems. Their ability to operate at very low well pressures and boosting the well flow to a central facility at the same time makes them particularly suitable for the use on matured field. Beside the Multiphase Pump Skid there is usually no further treatment equipment required at the well site. Operation at very low suction pressures allows scale down or even abolishment of artificial lift. The elimination of flaring and venting for an increased environmental protection will be statutory in the majority of the oil producing countries. Multiphase pumps handling the entire untreated well flow are the ideal tool to prevent the release of greenhouse gases to the atmosphere.

Multipase pump packages are compact and of low weight. This makes them particularly suitable for the installation on offshore platforms. The pumps are usually driven by electric motors, however, solutions with gas or diesel powered combustion engines are available, for example, for wellhead platforms with no electricity available.

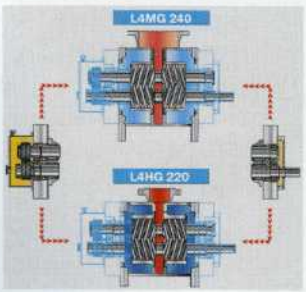
Twin-Screw Multiphase Pumps

Twin-screw pumps are of double volute design and hydraulically balanced. The pump bearings are lifetime optimised and not exposed to thrust loads. The hardened steel screws are manufactured from single piece bar stock. They are installed in a replaceable casing insert and neither in contact with each other nor with the casing insert. Oil lubricated timing gears transmit the torque from the drive screw to the idler screw. The screws are sealed by either single acting or double acting mechanical seals which are exposed to suction pressure only.



Cut-a-way of a Leistritz high pressure multiphase pump

When operating at high gas volume fractions (GVF) or at slug flow conditions, a small quantity of liquid must be provided between screws and casing insert to allow the compression of the gas phase. This is achieved by an external liquid management system which is sufficiently sized for the expected length of slug flow.



Leistritz modular system for twin screw pumps

Modular System

During the past years, more and more twin screw rotary positive displacement pumps have been installed upstream onshore and offshore in the oil and gas industry as multiphase pumps, booster pumps, produced water or pipeline start-up pumps. Depending on the particular duty, low, medium and high pressure pumps with a wide range of flow rates are installed.

The variety of pump models always requires a considerable minimum spare parts inventory. Leistritz Pumpen GmbH has now addressed this situation with the re-designed L4 Series Twin Screw Pumps. Instead of individual design without a particular system, all pumps are designed and manufactured in accordance with a modular system. While pump casings, liners and screws are still adapted to the particular operating conditions, are bearing covers, bearings, timing gears and the seal components interchangeable among pumps of different sizes.

The operators benefit from a more economical stock keeping with a reduced number of individual parts as well as from alleviated maintenance of the improved pump design. The modular system covers both Industrial and Multiphase Pumps of the Leistritz L4 Series Twin Screw Pumps. ■

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